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Methodology, the Matching Law, and Applied Behavior Analysis

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The practical value of the quantitative analysis of behavior is limited by two methodological characteristics of this area of research: the use of (a) steady-state strategies and (b) relative vs. absolute response rates. Applied behavior analysts are concerned with both transition-state and steady-state behavior, and applied interventions are typically evaluated by their effects on absolute response rates. Quantitative analyses of behavior will have greater practical value when methods are developed for their extension to traditional rate-of-response variables measured across time. Although steady-state and relative-rate-of-response strategies are appropriate to the experimental analysis of many behavioral phenomena, these methods are rarely used by applied behavior analysts and further separate the basic and applied areas.

Recently, a number of authors have begun to assess the importance of the matching law (Herrnstein, 1970) for the analysis of human behavior in natural settings. Pierce and Epling (1983), for example, reviewed the evidence for matching in the human operant literature, and others have suggested that matching has important implications for applied behavior analysis (Epling & Pierce, 1983; McDowell, 1981, 1982; Myerson & Hale, 1984a, 1984b). This trend represents a valuable link between the operant laboratory and the amelioration of social problems. Despite the broad impact of quantitative analyses of behavior on the animal literature (see de Villiers, 1977, for a review), two methodological characteristics of this line of research limit its usefulness for applied behavior analysis: (a) its emphasis on steady-state vs. transition-state behavior and (b) its emphasis on relative vs. absolute rate of response.

STEADY-STATE VS. TRANSITION-STATE BEHAVIOR

The matching law and related quantitative statements of the law of effect (e.g., global maximizing, momentary maximizing, and melioration) represent a topic which has been explored primarily through a methodology Johnston and Pennypacker (1980) termed the "steady-state strategy" (p. 225; see also Sidman, 1960, chaps. 8 and 9). Typically, an organism is exposed to a schedule of reinforcement, or some combination of schedules, for from 10 to 35 daily sessions, and measurements of response and reinforcement rates are made in the final sessions when session-to-session variation is minimized and a stability criterion has been met. The data from earlier sessions are not reported or analyzed, and, in the case of matching law research, no predictions can be made about rates of behavior at these prior points.

Applied researchers and clinicians seldom have the option of choosing between steady-state and transition-state strategies. In field settings, the task of the behavior analyst could be described as providing the change from one stable rate of response to another. Presumably, in reversal designs, baselines are characterized by higher rates of undesirable behavior and lower rates of desirable behavior, whereas the stable post-intervention rates of each would be reversed. Interventions in applied settings, however, like those in the operant laboratory, rarely produce an instant transition from one steady-state performance to another. Behavior change is often gradual, spanning several days or sessions before attaining a maintenance level; moreover, the shape

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of this transition can be quite different for different interventions. Consequently, applied behavior analysts assess treatments across time: from baseline, through transition, to stable post-intervention levels. In most cases, measurements of behavior are as continuous as possible in a given setting, and are not segmented on the basis of instability.

Recently, theories derived from the matching law have been developed for the quantitative analysis of the acquisition of operant behavior (e.g., Myerson & Miezin, 1980). As research develops in this area, there may be a return to the analysis of transition-state behavior, which would ultimately lead to further advances in applied behavior analysis. The current trend, however, is in favor of steady-state behavior.

RELATIVE VS. ABSOLUTE RATE OF RESPONSE

Within the experimental analysis of behavior, Catania (1981) has demonstrated that relative response rates (e.g., the proportion of responses on a given component of a concurrent schedule) can hide important effects observed in absolute response rates, and has argued for a return to traditional rate-of-response measures. The point would be equally as valid for applied research investigations. But, outside the operant laboratory, this issue is not a topic of debate, because the applied behavior analyst's social environment insures that absolute-rate-of-response measures are used. The effectiveness of an intervention can rarely be assessed in relation to other behavior. For instance, a treatment for the elimination of aggressive behavior could not be evaluated by a statement that, "Bill's proportion of aggressive responses to nonaggressive social responses was reduced from .60 to .15. In fact, the absolute rate of an inappropriate behavior can actually increase as its relative rate decreases, if the absolute rates of both appropriate and inappropriate behavior increase.

Although acceptable levels of various behaviors are determined in a somewhat normative fashion, based on what the culture supports, these levels are most often defined in absolute, rather than relative, units. As a result, applied researchers have shown a greater loyalty to rate of response as a primary dependent variable.

METHODOLOGY AND EDITORIAL PRACTICE

The matching law literature is perhaps the most obvious example of how steady-state and relative-rate-of-response methodologies contrast with the methods and goals of applied behavior analysts, but the problem is not limited to this line of investigation. In general, the two major behavior analysis research journals show very different editorial practices. For example, in 1985 (Vol. 18), 70% (52/74) of the figures printed in the *Journal of Applied Behavior Analysis* included an absolute rate of response measure plotted across successive units of time. For the same period (Vols. 43 and 44), only 25% (62/247) of the figures in the *Journal of the Experimental Analysis of Behavior* (*JEAB*) depicted rate across time.[1]

These results suggest a strong preference among applied behavior analysts for rate-across-time methodologies, but several of the other strategies are worthy of note. First, 11% (8) of the figures from *JABA* came from community-based studies in which relative-rate-of-occurrence data were presented (e.g., percentage of motorists yielding). Second, despite the popularity of measurements across time, 12% (9) of the figures depicted simple pretest/posttest data or his-

[1] For the purposes of this analysis, a "figure" was defined as (a) having a figure caption and (b) presenting original data. Where several graphs or histograms were associated with a single caption, the figure was counted as one occurrence. A rate-across-time figure was counted if at least one of the graphs presented included (a) a simple frequency count or rate-of-response measure (e.g., responses per min) across (b) successive units of time (e.g., mins, days, sessions). Measures involving percentages were only counted if the number of trials or opportunities upon which they were based was stated in the article and was held constant across time. In these cases, the percentage plot would mirror the absolute frequency plot, if both were presented.

tograms of rates of behavior during various experimental conditions. Finally, 8% (6) of the figures showed time-based measures, such as percentage of intervals on-task. In contrast to rate of response, these time-based measures may provide a link to the matching law, which has been applied to time allocation on concurrent schedules.[2]

Although these other methods were observed, only 3% (2) of the sampled *JABA* figures included neither an absolute-rate-of-response variable nor measurements of behavior across time. *JEAB*'s different purpose makes it appropriate that other methodologies and dependent variables be used, but few of the phenomena studied will have an impact on research and practice in applied behavior analysis unless they can be described using rate-of-response measures across both steady and transition states. In the case of the matching law, theory suggests that absolute rates of response for various interventions could be predicted, but outside the laboratory the naturally occurring rates and amounts of reinforcement necessary to make these predictions are difficult to quantify accurately. Furthermore, as noted above, relatively little research has examined acquisition and other transition-state phenomena.

CONCLUSION

Several authors have debated the pros and cons of the "flight from behavior analysis" (Michael, 1980, p. 1), a development, primarily within the applied area, characterized by a shift in emphasis away from philosophical and scientific goals and toward professional and technological ones (Baer, 1981; Dietz, 1978; Michael, 1984; Poling, Picker, Grossett, Hall-Johnson, & Holbrook, 1981). In his explanation of this trend, Michael (1980) points to a number of factors related to the growth of applied behavior analysis, such as the development of a unique methodology appropriate to the applied field and an influx of people who have neither philosophical commitments to behaviorism nor adequate training in basic behavioral principles. While arguing for greater unity between the basic and applied areas, Michael (1980, p. 12) admits that much of the current research presented in *JEAB,* particularly studies addressing theoretical aspects of the matching law and ethological issues, is more difficult to extend to the human case.

If research in *JEAB* has fewer applied implications, however, it is not only because the topics addressed are unrelated to social problems. The methodologies employed to examine a wide variety of issues are increasingly foreign to those of the applied area. Although the adoption of steady-state strategies and relative-response measures within basic research, as well as their apparent rejection within applied research, may be appropriate to the goals of each, these differences represent an important obstacle to the reunification Michael advocates.

[2] Of the 22 excluded *JABA* figures, 7 did not show measurements across successive units of time, 13 lacked absolute-rate-of-response measures, and 2 met neither criteria.

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